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A DECENTRALISED APPROACH TO WASTEWATER MANAGEMENT IN THE URBANISING REGION

The Case of Jakarta, Indonesia

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Abstract

State-led and market-oriented approaches to sanitation development in Jakarta have favoured the construction of large-scale centralised sewerage systems. This development approach is not always suitable, because the principles of modern infrastructure underlying the technological systems are not applicable to informal settlements scattered over the metropolis. Due to spatial fragmentation within the built environment, diverse socio-economic and fragile geo-ecological conditions in different settlements and the city as a whole, Jakarta needs to adopt a decentralised approach to wastewater management. This article examines governmental dynamics in Jakarta and analyses a sanitation project introducing improved septic tanks and community sludge-hauling enterprises. The presence of (international) NGOs and civil society organisations is often vital, to help communities enrich their technical knowledge of environmental problems and expand their socio-political networks. Nevertheless, local initiatives provide a limited response to community sanitation needs and the overall sanitation problems beyond the neighbourhood level. This article argues that the application of decentralised sanitation systems necessitates a new-form of state-led infrastructure provision that involves the (transformative) participation of local actors. It extends the notion of decentralised wastewater management beyond purely technological concerns.

1. INTRODUCTION

This article considers three urgent issues about planning and development processes within the sanitation sector of cities in the Global South. *First*, the state has not responded properly to various sanitation problems within the heterogeneous urban environment. Improving poor sanitary conditions in informal settlements requires different strategies from those adopted for housing estates and business districts (Mc Garry, 1977; McGranahan, 1993; Parkinson & Tayler, 2003; see Bakker et al., 2008; Gerlach & Franceys, 2010). *Second*, the environmental sanitation problems have been treated as if household sanitary needs are disconnected from the whole city and river basin systems, hence, they have been addressed through fragmented development programs (McGranahan, 1993; Parkinson & Tayler, 2003; Novotny, 2009; Suriyachan et al., 2012). *Third*, alone, neither the state nor the private sector can provide basic sanitation services for all (Ostrom, 1997; Bakker et al., 2008). However, involving various actors in sanitation service provision, including the communities themselves, requires national and local governments to act as strong regulators and instigators, which is often not the case in countries of the Global South.

This article contributes to the study of environmental sanitation development processes in megacities of the Global South by focusing on these three critical issues as they have materialised in Jakarta. It comprises four main sections. Following this introduction, **section two** argues for the decentralised approach to wastewater management as an alternative to the centralised water and wastewater provision system. This section begins by showing why, in principle, the centralised model has failed to provide basic sanitation infrastructures for all inhabitants. **Section three** continues the discussion by briefly tracing the

trajectory of Indonesian sanitation development sector. The national government has promoted decentralised wastewater management systems within the policy making arena. A transformation of the technocratic planning practices is necessary for operationalising the decentralised approach to wastewater management and sanitation development.

Section four discusses the environmental sanitation development processes and institutional dynamics in Jakarta. The latest wastewater masterplan still favours capital-intensive technologies i.e. large-scale sewerage networks and large wastewater treatment plants, at which this article critically looks. **Section five** brings a perspective from one of Jakarta's kampungs, to give an insight about 'local' community dynamics into the sanitation sector development. A 'kampung' refers to an enclave of traditional settlement that is often categorised as informal settlement. This section discusses the governance of a prospective decentralised wastewater management system at the sub-district scale, stemming from a sanitation development programme introduced by an international NGO in Kampung Kojan, Kalideres Sub-district.

The analyses in this article are based on data obtained from planning documents made at the national and provincial levels, as well as series of fieldwork. From May to December 2011, the author conducted a fieldwork in Kampung Kojan and interviewed 16 beneficiaries of the programme, their household members (including the tenants of benefited landlords) as well as some local leaders. In addition, several interviews were conducted beyond the kampung level, between August 2010 and October 2012, involving officers and field staff of the NGO. The author has also interviewed officials from several national, provincial and municipal agencies during the above period and recently in spring 2017, to reveal the interplays between the national and provincial policies. A follow-up visit to the Kampung has been done by a research assistant in 2017.

2. DECENTRALISED WASTEWATER MANAGEMENT AS AN ALTERNATIVE?

There are contradictory sides of the traditional policy framework of water infrastructure development, which relies on the concepts of efficiency and equity. Within the capitalist regulation framework, the finite nature of water resources has led to a concept of water as an 'economic good', but an efficient state management system has to be in place to protect individual rights to water if not misallocation occurs (Ostrom, 1997). Big urban agglomerations consume big volumes of water and produce plenty of wastewater to which the state and corporates have responded by developing large-scale technological systems to deal with scarcity and pollution. It is argued that economies of scales can be reached within such systems (Ostrom, 1996; Bakker, 2003; Gerlach & Franceys, 2010). In fact, the centralised sewerage and potable water infrastructure models are capital intensive - requiring continuous big funding for their construction, operation and maintenance - while recovery of investment costs is generally very poor (Parkinson & Tayler, 2003; Gerlach & Franceys, 2010). A slow recovery of investment costs further legitimates the state for organising long-term (investment) planning and (subsidised) water and sanitation service provisions (Ostrom, 1996; Bakker, 2003; Whittington et al., 2012).

In the case the state is not anymore considered as the key actor to ensure the pace of infrastructure development and universal access to water and sanitation services, the principle to collectively organise water and sanitation service provisions is maintained and has been reformulated (see Gerlach & Franceys, 2010; Araral et al., 2011). While subsidies have been reduced or even stopped, involvement of the private sector to invest in the sector is legitimised for improved governance. The industrialisation i.e. mass-production and collective

organisation of water and sanitation infrastructure provisions in the Global South that started in the 1980's, in fact, has been inseparable from the commercialisation of the services and privatisation or corporatisation of state utilities (Bakker, 2007; Dagdeviren, 2008).

According to the privatisation logic, communities are no longer conceived as groups of 'citizens' whose rights to basic sanitation services should be met fully by the state (see Allen, Davila, et al., 2006). Satisfaction of water and sanitation needs is evaluated based on customer values, even by the community members themselves; those who pay have the right to demand good services (see McFarlane, 2008). For efficiency, the state needs to facilitate market competition and encourage private entities to participate in the market by offering the cheapest possible standardised water supply. However, market competition is impossible to achieve due to the strong and resilient network monopoly characteristics of the centralised water and sanitation infrastructure systems (Graham, 2002; Davis, 2005). Considering that a pipe network requires big capital investments, it has been considered as non-economical to have two or more providers operating in the same area because two or more competing networks would be overlapping (Graham, 2002). Moreover, being capital intensive, the water and sanitation sector requires long-term planning processes, which do not suit the risk-minimisation and profit-maximisation priorities of private companies (Davis, 2005).

There are several models to deal with the unattractiveness of the water sector for private companies (for reviews see Davis, 2005; Araral et al., 2011). The most common strategy is to divide the market into several service areas to have one operator for each of the operational territories. Once contracts have been awarded to the most competitive firms, however, the nature of competition erodes and the population within a certain operational territory can only be served by a 'local' monopoly service provider (Graham, 2002; Davis, 2005). To answer the equity challenge within the monopoly scheme, tariffing has been

instrumented. But contradiction remains (see Dagdeviren, 2008). While ‘affordability’ and ‘equity’ have to be respected (Araral et al., 2011), sufficient funds to cover the operational costs and profits for the shareholders and/or further investment (e.g. expansion of the infrastructure networks) have to be generated (Davis, 2005; Dagdeviren, 2008).

In contrast to the water sector, the state in countries of the Global South is less successful in facilitating the commercialisation of environmental sanitation. In many developing countries, privatisation of water supply has increased over the past two decades (Argo & Laquian, 2004; Bakker et al., 2008). Clean water is a commodity that the private sector is willing to invest in because end users are willing to pay for the service. The wastewater sector has weaker managerial frameworks compared to clean water supply (see Davis, 2005; Motta & Moreira, 2006; Araral et al., 2011). Who does what for the development of the sector is not clear and there has been very low commitment to improve the sanitation condition at all governmental levels. Moreover, vertically integrated policy making processes for environmental sanitation development are not in place (Araral et al., 2011). The low level of regulation in the sanitation sector can be seen as a result of its long-time neglect in the development processes.

Substantive empirical evidence has shown failures of the market-oriented development strategy to meet the basic infrastructure needs, especially of those with the lowest income, rural communities and inhabitants of peri-urban areas (Hardoy et al., 2005; Allen, Dávila, et al., 2006; Bakker et al., 2008). Large-scale and centralised wastewater management, the standardised system promoted by the market-oriented development strategy, is not suitable for cities in developing countries that generally are vast due to uncontrolled urban sprawl and characterized by various levels of density and enclaves of non-planned settlements (Parkinson & Tayler, 2003; Mara & Alabaster, 2008). To serve the entire city with an off-site system is

not efficient, because wastewater has to be transported and pumped over a long distance to a treatment plant while clean water reclaimed from the treatment process has to be distributed to other areas to be used; and the large-scale sewerage model also requires a lot of water to flush (Medilanski et al., 2007). With the centralised piped-water and sewerage systems, it is impossible to balance the needs to consume and capabilities to produce as well as to balance the pollutants generated and efforts to clean up at the local level.

In contrast, decentralised wastewater management has a principle to handle and treat wastewater 'as close as practical to where it is generated and to where its potential beneficial reuse is located' (Suriyachan et al., 2012) or, in other words, it allows a complete cycle of wastewater treatment processes at the local level in which all volumes of influent are treated into a safe and/or useful product. It promotes an efficient provision system in the sense that development practices of other sectors, e.g. clean water supply, agriculture, water transport, water-front public space and flood management can be taken into account while solving the problems of wastewater management. The application of alternative technologies for sanitation development has also been seen as an entry towards the reforms of the state-market-centred institutional arrangements.

Many governments of cities in the Global South have begun to endorse small-scale, low-cost wastewater infrastructure systems, which also increase the involvement of actors outside the state and established private companies to play greater roles, including the role as providers of improved sanitation services. However, it is not uncommon that the obduracy of centralised approach lingers within the technical and bureaucratic routines of water governance. The next section scans the trajectory of Indonesian urban sanitation development sector since the 1980s and discusses how the planning system has been transforming towards a more decentralised approach.

3. THE INDONESIAN SANITATION DEVELOPMENT SECTOR

The Indonesian sanitation sector consists of domestic clean water provision and wastewater handling, also solid waste and drainage management. It is occasionally addressed together with the road sector within a multi-sectoral urban infrastructure policy making. A particular trajectory of the Indonesian urban infrastructure sector that is important to notice was the accelerated large-scale planning approach in the 1980s.

The Integrated Urban Infrastructure Development Programme (IUIDP) was launched in 1985 to combine several infrastructure sector developments in addressing infrastructural needs at city-wide scales. It was fundamentally forced by the needs to structure urban areas as centres of economic growth (S. Soegijoko, 1992). The IUIDP responded to the previous infrastructure development processes that were considered fragmented, project-oriented, not considering long-term needs and addressing only particular infrastructure problems in the project areas (B. T. Soegijoko, 1992; Hoff & Steinberg, 1993; Mattingly & Winarso, 2000).

It turned out that the IUIDP strategy was failed to be implemented as designed, as admitted by several officials at the Ministry of Public Works (author's interviews, 2010). The integration of different sectors had made the development plan bulky and its related projects were delivered by returning to the old way of doing: sectoral and fragmented. The projects were merely large construction works dominantly led by the Ministry of Public Works. They were fragmented in the sense that physical developments were disconnected from the socio-cultural dimensions and the real (long-term) community needs. Another fundamental failure was the absence of a framework for local government capacity building and community empowerment that is necessary to pursue the expected integration at the neighbourhood level.

Although through IUIDP, the Indonesian government conceptualised for the first time that environmental sanitation as a development sector has to be organised at a city-wide level and integrated with other urban infrastructure sectors, sanitation development especially wastewater management remained the lowest priority among other IUIDP components. Road constructions received the biggest funding, followed by drainage, clean water provision and solid waste management. Within the Indonesian infrastructure sector, wastewater typically received 3-5% of the investment programmes while drainage, 20% of the investment programmes (Miller, 2006). To sum, the scalar increase within the IUIDP happened at the expense of the sanitation sector.

The implementation of the Indonesian 1999 Law on Regional Administration in 2001, as one of the legal bases for the decentralisation and regional autonomy policies, has led the transfer of several responsibilities from the national to local governments. Likewise, water and sanitation provisions have become the task of local governments. Around this period, *Pokja AMPL Nasional* (National Working Group for Drinking Water and Environmental Sanitation Development) was formally grounded. Several senior civil servants at the *Pokja* realised that top-down policy making processes and large-scale infrastructure developments had failed to significantly increase the access, especially of the poor, to water and sanitation infrastructures (author's interviews, 2010 and 2011). The *Pokja* considered that transferring the responsibility of water-sanitation infrastructure development to local governments should become an opportunity to involve more actors in the sector's decision making processes and to empower communities to be able to provide simpler and cheaper water-sanitation facilities (author's interviews, 2010 and 2011).

In 2003, as one result of the partnership involving *Pokja AMPL Nasional*, the national government launched 'the National Policy for Development of Community-Based Water

Supply and Environmental Sanitation'. The new national policy was designed as an instrument to promote a community-based approach in the water supply and sanitation sector development and was manifested into two key programmes: PAMSIMAS and SANIMAS. With this approach, neighbourhood is the crucial spatial dimension, in contrast to the earlier IUIDP approach.

Realising that several important aspects of urban development are either missing or insufficiently developed in the 2003 National Policy (see also Miller, 2006), a new national strategy, embedded in a new national programme, was launched in 2009: *Program Percepatan Pembangunan Sanitasi Permukiman* (PPSP) or acceleration programme for urban sanitation development. Many public officials at both the national and provincial levels saw that: i) PPSP promotes sanitation development as one of the top priorities within the agendas of local governments; and ii) it was an improvement to the community-based approach that has overly focused on neighbourhood development while neglecting city-wide and long-term planning (author's interviews, 2010 and 2011).

PPSP introduces city sanitation strategy (*Strategi Sanitasi Kota*, SSK), which could be seen as a strategic planning instrument, to map existing sanitation conditions in a city or regency and to plan a proper development strategy based on the existing condition. SSK should include a sanitation infrastructure master plan that defines areas possibly developed with centralised sewerage models, communal systems and on-site/ individual systems.

If SSK could be instrumented well, the decentralised approach to wastewater management by applying community-based low-cost sanitation technology would not end to fragmented development interventions (see also Lüthi et al., 2010). In principle SSK could provide a frame of reference for guiding development practices in which a territory-based community can collectively define urgent 'local' needs, in relation to increasing 'city-wide'

problems in the water sector – e.g. groundwater depletion, flooding and rising sea levels. At the city-wide level, the benefits of decentralising wastewater management include overcoming the technological bottlenecks caused by large-scale sewerage systems.

It sounds good on paper, but it remains a huge task to venture decentralising wastewater management as means for creating political space at very local levels, thereby enabling local stakeholder participation in planning and decision making processes. Participation necessitates two-way interactions between the state and the society. Often communities are not able to initiate changes and/or push the government to include them in the planning process, nor are they ready to play a greater role in development processes because they are trapped in short-term survival strategies and also face structural and cultural barriers (Hickey & Mohan, 2005).

Hence, the SSK needs to be institutionalised beyond the market logic and its instrumentality to attract capital investments for inter-urban competitiveness. Accordingly, local governments should function more than fund managers and regulators, to be innovators to include several social and cultural dimensions within the development processes, or otherwise planning will return to the usual bureaucracies for technocratic prescriptions as we could see within the latest wastewater master plan of Jakarta (hereafter the 2012 Master Plan), further discussed in the following section.

4. THE ENVIRONMENTAL SANITATION SECTOR IN JAKARTA

The Special Capital Region of Jakarta (*DKI Jakarta*) is populated by ten million residents and three million floating inhabitants. It is administered by a provincial government and

geographically part of a larger urban agglomeration called Jakarta Metropolitan Area, in which approximately 27 million people live.

In the capital city, a 'centralised' sewerage system covers only less than three per cent of its area. It was developed during the 1980s IUIDP and after more than 30 years, no expansion of the system has been significantly made. There are some on-site systems operated by the provincial government, mainly in public markets and governmental offices. The overall state-provided system serves 15 per cent of the population.

Outside the existing state-organised systems, wastewater handling remains unregulated. While informal settlements and slums have been considered as the main areas without appropriate sanitation infrastructures, actually a proper environmental sanitation management is also absent in many housing and commercial estates. The massive yet fragmented urban physical development has not been accompanied by strict environmental controls for socio-ecological sustainability.

In principle, in areas served by the state sewer-trunks, large buildings such as offices, shopping malls and apartments have to be connected to the centralised system. If not, self-organised wastewater treatment systems have to be in place with a prior approval and regular inspections by the state i.e. the regional environmental management agency (*Dinas Lingkungan Hidup*). However, several officials from different provincial agencies do not see the *Dinas* having the capacity to control the quality of diverse systems applied in Jakarta (author's interviews, 2011 and 2017). The situation is not better in regards to the development of landed houses. For the category of 'small and simple building', an estate developer is not obliged to provide collective wastewater treatment plants for the entire housing complex. Building permits are issued for individual houses and there is no specific requirement for its wastewater collection and treatment.

It is a common practice that landed houses, self-built or provided by the real estate sector, are equipped with septic tanks. 'A city with millions of septic tanks', an official at the Ministry of Public Works described Jakarta's sanitation condition (author's interview, 2010). Up to 2005, it was estimated that in the city, there were 1.6 million septic tanks serving individual houses (Miller, 2006). A septic tank normally is used for recovering black water containing human excreta while grey water produced from washing and bathing remains untreated before being charged into the ground and water bodies. In many cases the operation of a septic tank is the individual owner's responsibility. There is no quality control for the septic tanks, allowing leaking ones keep in place.

The latest wastewater master plan of Jakarta was initiated in 2010 and the draft was finished in 2012, with funding from the Japan International Cooperation Agency (hereafter JICA) and technical assistance from some Japanese consultancy firms. The new master Plan (hereafter *the 2012 Master Plan*) proposes fifteen zones of large-scale sewerage networks with separate wastewater treatment plants and these zones should be implemented in three stages of development up to 2050. It is estimated that in total, the off-site systems will cover 80 per cent of the Jakarta area while it is assumed that on-site systems will suit the other 20 per cent that consists of slums and informal settlements (Yachiko Engineering, 2012).

It sounds ambitious to propose that the sewerage networks would cover 80 per cent of the Jakarta area. Around 65 per cent of the formal development in Jakarta is actually residential areas and they were developed in fragments. The last five decades have witnessed the hindrances to build or expand the centralised sewerage network and the spatial fragmentation has been the significant cause. The socio-economic heterogeneity of urban life adds the complexity. The 2012 Master Plan unreasonably assumes that communities would voluntarily connect to the new sewerage networks while necessary legal frameworks have not

been in place. A key staff within the water agency recently stated that with the irregular socio-physical pattern, only 20 % of Jakarta could actually be served by sewerage networks (author's interview, 2017).

It has been acknowledged in the 2012 Master Plan that within each sewerage zone, there are enclaves of slums. Strategies to incorporate these specific enclaves have not been made. Although on-site sanitation systems are considered necessary, their roles to improve Jakarta's environmental condition is seen minor. There are some normative suggestions in the planning document, for example, that the quality of septic tanks have to be improved, i.e. waterproof, durable, and capable to also treat grey water. But, the current strategy does not go beyond the logic of individual septic tanks, which are not suitable for a crowded urban setting like Jakarta. Moreover, discussions and anticipations in regards to the socio-economic dimensions of urban life are missing, leave alone an assessment on the community potentials to develop better on-site sanitation systems.

Jakarta's *Pokja* on Sanitation has prepared a city sanitation strategy, the SSK document, in which several areas have been recognised for having poor sanitary conditions. But the 2012 Master Plan carries on the 1980's approach of IUIDP, dominated by the spirit of technology-centred solutions and without communities providing input on their needs. The SSK was enacted in Jakarta relatively late compared to other (secondary) cities (author's interview with a key official of the National Planning Board, 2010) and its presence has been less influential within the policy making arena (author's interviews, 2012 and 2017).

The lingering concept of large-scale centralised water management in Jakarta cannot be separated from the corporatisation of state water utilities and commodification of urban space. Many civil servants argued that the water and wastewater companies have no capabilities to increase services to the poor because maintaining the current operations has

been a big challenge. They also argued that the government should prioritise commercial functions and upper middle class settlements, to 'tap revenues through the sewers' and sustain the state wastewater company (author's interviews with several staff from the water agency and utilities, 2011-12 and 2017). The water and wastewater companies have actually been generating profits for the provincial state and other shareholders. PD PAL Jaya rendered around 40 per cent after-tax income to the state (Miller, 2006) while one of the private water companies made more than 25 million USD of profit in one year (Ardhianie, 2011; see also Hadipuro & Ardhianie, 2011).

It is a serious flaw that the provincial government of Jakarta has not applied an alternative decentralised approach to environmental sanitation. The most crucial issue is an absence of effective institutional frameworks to incorporate diverse spatial and ecological configurations, also to understand the community dynamics and incorporate them into the policy-making processes. In this kind of situation, the following project becomes one important example to push forward the improvement of Jakarta's sanitary condition.

5. A PERSPECTIVE FROM *KALIDERES SUB-DISTRICT* AND ITS KAMPUNG KOJAN

Mercy Corps (hereafter MC) is one among few organisations that has been working on urban poverty issues, especially in Jakarta. Between May 2009 and December 2010, MC delivered the Program of Urban Sanitation & Hygiene Promotion (PUSH), in which one main project component is testing an alternative technology of modular septic tanks that meet the quality standard set by DKI Jakarta Province. The project directly benefits 219 from around 1,600 households in Kampung Kojan. Although the size sounds insignificant to the problems of

Jakarta, the project brings three fundamental ingredients to improve the condition of environmental sanitation beyond the Kampung and to successfully integrate different community needs.

First, it addressed the neediest beneficiaries. While individual poor households were selected at the beginning, owners of rental houses were targeted in the last stage and 35 septic tanks for communal latrines were delivered. The tenants have enjoyed immediate benefits of having latrines in close proximity to their rental rooms, saving the time for domestic works and hence increasing their income value. The strategy to provide communal facilities has addressed the needs of tenants, including temporary workers and circular migrants, who can be considered the poorest groups among the community. In Kampung Kojan, some 41 per cent of the households rent a house or room and most of them have no access to bathrooms and toilets (SUEZ-Environment & Mercy-Corps, 2010). Labourers and low-level employees compose around 16 per cent of the population and many of them work on short-term contracts in the factories and warehouses located nearby. There is also a significant number of petty traders.

Second, the design of the septic tank was quite innovative. It adapts the government-standardised septic tank by proposing two smaller separate compartments (or three if it includes the treatment for grey water) instead of a single bulky container with internal partitions. The two compartments were designed for storing the sludge and for treating the liquid material with a bio-filter before discharging it into the ground or water bodies. The modular shapes can be rectangular or circular and the distance between the two compartments can be adjusted to the availability of land, considering that about 32 per cent of the Kampung's inhabitants live on plots smaller than 29m^2. Made from concrete, the modular elements can be moulded on-site with construction materials that are available in the market

and familiar for local builders. Ready-to-install septic tanks are actually available in the market, but they are made from fiberglass that might be foreign to local construction workers and the price is much higher.

Third, it connected the needs for infrastructure development to the desires for livelihood improvement. MC found that illness of any family member causes extra expenditures for health treatments, including the cost of transportation to health care centres, and this often leads to a fall in real income. Moreover, as desludging process of septic tanks can create new jobs and open entrepreneurship opportunities, MC created an entrepreneurship system called *PELITA* (an abbreviation of *PEngolahan LImbah TinjA* or fecal waste treatment; as an Indonesian word, 'pelita' means 'lights' and this term was used to popularise the project among community members). PELITA was designed to provide services to haul the sludge from septic tanks. It was expected that local technical knowledge and engineering skills in sludge management could be increased and accumulated.

MC designed and funded two small motorized vehicles to collect sludge from individual septic tanks that need to be operated by two persons. The vehicle was designed to function in small alleys that cannot be reached by the municipal's desludging trucks. MC also assisted a cooperative (*KJK Kalideres*) to deal with financing issues in sanitation infrastructure development, developing a sanitation marketing system, and promoting a micro-finance scheme in the form of revolving funds that allow a family to get soft loans and a small subsidy to install an improved latrine and/or modular septic tank. It was expected that an increased demand of the septic tanks would trigger local business entities to produce the modular concrete elements of the tanks. Figure 1 shows an example of flyers produced by the cooperative to promote the use of septic tanks.

Figure 1 is about to be here.

Figure 1. A flyer saying: 'The smell reaches the alley, but when septic-tank comes, it's gone. Quick, install one! Call [the number]'.

Source: Mercy Corps, 2011

The PUSH project was well designed but whether such schemes would sustain in a longer run remains a question. There are limits to the interventions of MC. MC was not able to facilitate the cooperative to think beyond the logic of individual septic tank by targeting groups instead of households for generating the sanitation revolving fund. A field visit to Kampung Kojan in 2017 indicated that the willingness to pay for sludge hauling is diminishing among the community members. Insecure livelihoods and low income have been the central issues in their lives. The project has not been able to link sanitation to the broader dimension of livelihoods, perhaps by introducing urban agriculture (Furedy, 1990).

The project interventions have offered alternative technological models for household wastewater collection, but unfortunately there is no effective higher institutional arrangement to support the introduced model to function well and be upgraded as parts of a city-wide wastewater management system. PELITA has been facing some difficulties. In one operating day, often there was only one call for a desludging service. In this case, the operational cost would be relatively too high because the enterprise has to pay for two workers, their food allowance and the fuel to operate the machine. PELITA can only provide sludge-collecting-services at the sub-district level and the vehicles still need to transfer the sludge to a city sludge hauler truck for transporting it to the dedicated STPs. This means another cost element. The regular tariff is applied for PELITA if they use the city sludge hauling trucks. Unfortunately, MC has not managed to help PELITA finding a piece of land to build

temporary storage for the sludge before transferring it to the city trucks. This would support the irregular patterns of sludge hauling in the Kampung.

It could be argued that the intervention by Mercy Corps and the cooperative through PUSH was a vital step to assist the communities in seeking solutions to the environmental sanitation problems by optimising the existing community knowledge and practices. A septic tank is actually a pre-treatment technology that requires further steps: the collection and final treatment of the sludge. In principle, the presence of household interceptor tanks (septic tank, Imhoff tank, or other types of sedimentation tanks) would simplify the technical requirements of a local sewerage system, for example the one that is widely known as 'solids-free sewers' or 'effluent drains' (Otis & Mara, 1985). Moreover, communal septic tanks can be constructed simultaneously with an improvement of the existing open space. Further improvement with local simplified sewerage systems would mean improving the spatial quality of urban kampungs because the space in between houses have to be arranged for the new pipelines and this can be an opportunity to improve (semi-)public open space.

Kalideres sub-district, in which Kampung Kojan is located, is not part of the priority areas in the 2012 Master Plan. It covers an area nearly 500 hectares and is inhabited by 38,000 populations. PUSH and projects alike could actually be enhanced and advanced by instigating local stakeholders to develop a decentralised domestic wastewater management system at the sub-district scale. This approach might provide an institutional model for other 266 sub-districts of Jakarta. Any technological model of decentralised water management will take up a significant proportion of the land area in a neighbourhood for its implementation. But as proven in Bangkok (Suriyachan et al., 2012), land allocation for the final treatment plant within a decentralised wastewater management system would be more efficient. At the urban

scale, it is relatively easier to find smaller vacant land plots within the fragmented urban fabric.

At the moment, certain institutional settings that are necessary to anchor the local initiatives to long-term sanitation development processes are missing in Jakarta. Led by the sub-district government, neighbourhood leaders could have been involved more in organising the community to reach a consensus for collective sanitation infrastructures. The involvement of governmental agencies is essential, because after the completion of a project, an NGO has no further engagement with the community. Hence, state institutions and community organisations are needed to sustain and scale-up the initiative.

6 CONCLUDING REMARKS

Different sanitation needs embedded in the heterogeneous spatial dynamics of Jakarta have not been adequately met by state-led sanitation infrastructure provisions. This article suggests that the implementation of decentralised wastewater management is an urgent development agenda for Jakarta for two main reasons. First, it can overcome the technological bottlenecks inherent to the centralised system. Decentralising wastewater management means widening the technological options involved in environmental sanitation management. Have been discussed in this article, the sanitation development initiative in Kampung Kojan was designed to enhance the use of septic tanks for domestic wastewater treatment, and then link their use to a network of sludge hauling enterprises. Although it is only halfway to becoming a complete system of decentralised wastewater management with treatment plants, this article has shown possible institutional and technical methods to provide a complete cycle of wastewater management for the neighbourhood.

Diversifying technology is one step towards involving different stakeholder groups in wastewater management. This leads us to the second reason for implementing a decentralised approach to wastewater management. Decentralising wastewater management could mean creating (potential) political space at the very local level, enabling stakeholder participation in planning and decision-making processes. This political space includes alternative ways to finance household infrastructure development. In Kampung Kojan, a practice of sharing costs was introduced to build latrines and septic tanks, involving the NGO, landowners and their tenants. Sharing service production costs may enable payers to gain more control over service quality and means of accessing the service.

Indeed, affordability is a key issue when building (shared) latrines and septic tanks in the kampung. Although the NGO met most of the costs, decisions must also be taken as regards who should meet the cost of maintenance and further improvements to the system. As yet, no solution has been found to the question of how poor households will maintain their sanitation and have the chance to upgrade their shared latrines and septic tanks without spending a large portion of their income. NGO managers often assume that community sludge hauling enterprises may be able to accumulate a profit. Although this has not been reflected in reality, some may think that this potential profit could fund a local welfare system, while others may see it as an exclusive income source for particular community members. Certainly, a greater and solid involvement of communities is crucial for the success and sustainability of the development projects – and this is often a problem.

The case of Jakarta and Kampung Kojan show that there are complex institutional challenges involved in providing a complete wastewater treatment cycle at neighbourhood level. Improvements in local wastewater infrastructure systems need higher institutional arrangements beyond the sub-district level, with the state playing a greater and stronger role.

Certain institutional reforms are needed within the DKI Jakarta Provincial Government to move away from the centralised sewerage system as the only technical solution to environmental sanitation problems. There might need to be a policy to develop a city-wide sanitation development strategy that integrates various domestic wastewater management practices while ensuring the overall quality of environmental sanitation services and their accessibility to the community. The NGO intervention in the Kampung has benefited only a small number of households in Jakarta's kampungs, but such scale could be increased by replicating the same approach elsewhere. Unless the provincial government develops an overall sanitation development strategy and a long-term vision for local community development, it is difficult for any actor to deliver, replicate and/or upscale small-scale sanitation projects and integrate them into the city-wide infrastructure system.

There are many ways to design a decentralised wastewater management system at a neighbourhood level (Tilley et al., 2008 provide a review of different technological systems and their additional benefits for communities). With such a wide range of technological options for implementing decentralised wastewater management, an enabling environment, including long-term government support, becomes fundamentally important. Planners' main responsibility would consist not only in identifying possible technological options that comply with local specificities, i.e. climate, community knowledge, and institutional infrastructures. But designing broader participation is also needed, to decide at which scale units of a decentralised wastewater management system should be developed: should a treatment system unit serve one or two kampungs, or one housing estate and the adjacent kampung? These decisions must be taken by incorporating user preferences and local providers.

It seems that improving the existing wastewater management services in housing estates would be the most visible working agenda for the Jakarta government. Most of these

housing estates already have good drainage systems and a fairly uniform morphological pattern of neighbourhood physical structure. As such, it is technically possible to tap grey water and effluent from improved septic tanks or lay down an additional sewer system for black water. Besides, housing estate communities have relatively higher income levels and can meet the costs of such infrastructure services. The situation in urban kampungs is rather different. The case of Kampung Kojan exemplifies the difficulties to be addressed when seeking to improve wastewater management in a kampung of Jakarta. A decentralised wastewater management system must enable income regeneration of kampung communities. Given the heterogeneous environmental and socio-cultural conditions in Jakarta, the government mandate should include mastering a diversity of (alternative) technological options for wastewater management.

Hence, decentralising wastewater management is not without challenges, and perhaps it raises new issues that are currently not addressed by the governance of centralised wastewater management systems. Decentralising requires effective governance systems that operate simultaneously at different scales. Scaling-down could lead to fragmentations and a failure to address overall environmental problems adequately, certainly in the absence of integration processes through policies and legal frameworks at the larger scales. The case of Kampung Kojan shows that many neighbourhood-scale decision-making processes – between households and between two or more community groups – in fact depend on different dynamics at other scales of governance, involving the state wastewater company or international NGO, as well as the national policies in that sector. Likewise, dynamics at the neighbourhood scale feed crucial information back for defining development and operating strategies at the sub-district and city-wide scales.

It is unfortunate that the day-to-day activities of governmental bodies in Jakarta have long been directed to the implementation of a centralised water management system. But implementing decentralised wastewater management would open up possibilities for bottom-up yet integrated planning processes that can accommodate the different environmental problems of heterogeneous localities. Looking simultaneously at wastewater management problems at different scales, and especially at the sub-district scale, leads to awareness that the sector's problems can only be resolved by collaboration between professionals from different fields. One starting point could be to create synergies between the works of several governmental agencies. Conventionally, for example, sanitarians focus more on interventions at the household level while water managers tend to prioritise problems at the urban scale and believe in large-scale water works.

This article advocates the need for co-existence between off-site and on-site wastewater treatment systems. Co-existence between centralised and decentralised wastewater management systems would drive co-existence between state-led and community-led planning systems. The different characteristics of territorialised communities need flexible development policies, implemented using multiple administration techniques and operating procedures. Hence, there is a need to examine further how actors involved in both types of system can co-govern development in the environmental sanitation sector. This requires further research into community dynamics. It is necessary to understand under which circumstances community members are willing to co-operate with each other to collectively provide solutions to their environmental sanitation problems and beyond.

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